A risk modelling approach for setting microbiological criteria: using enterococci as indicator for Salmonella in pork

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A risk modelling approach for setting microbiological criteria: using enterococci as indicator for *Salmonella* in pork

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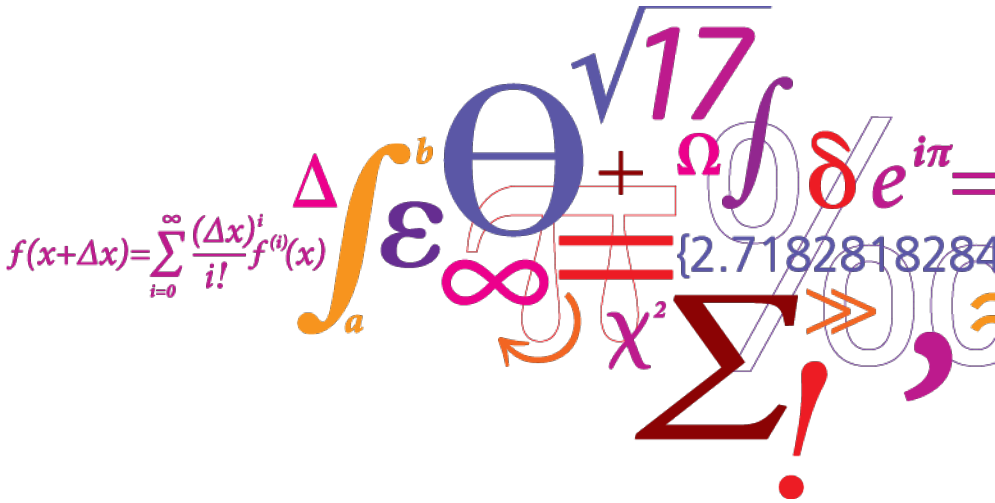
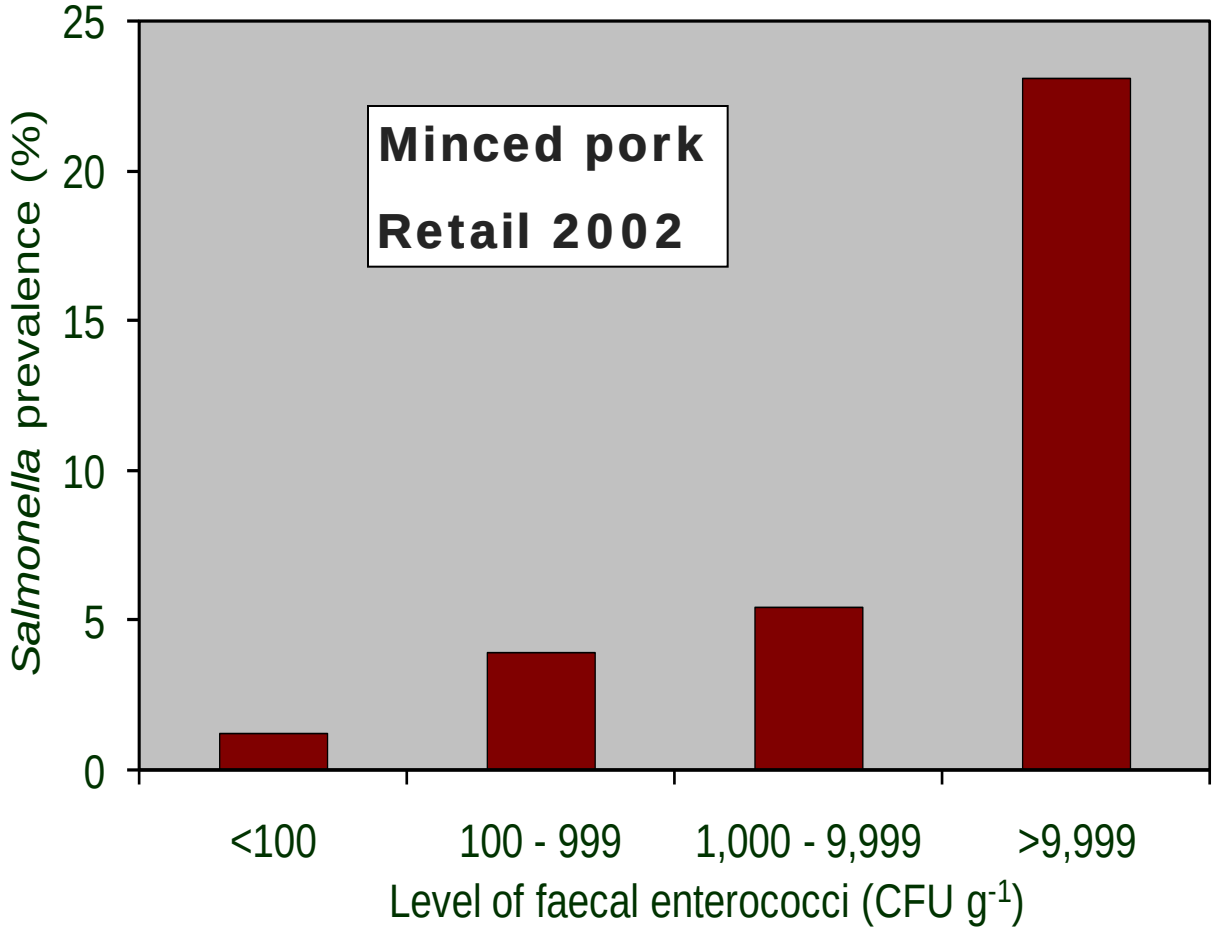


DTU Food
National Food Institute

Introduction

- *Salmonella* is considered a leading cause of human enteric disease in the world
- Around 30 % are considered to be caused by pork, in Europe
- From slaughter to retail, growth and cross-contamination increase consumer risk – the process hygiene is important
- Often a hygiene criterion is used to control process hygiene

Correlation between enterococci and *Salmonella*



Is it possible to estimate the consumer risk of salmonellosis from eating pork by measuring the level of a hygiene indicator?

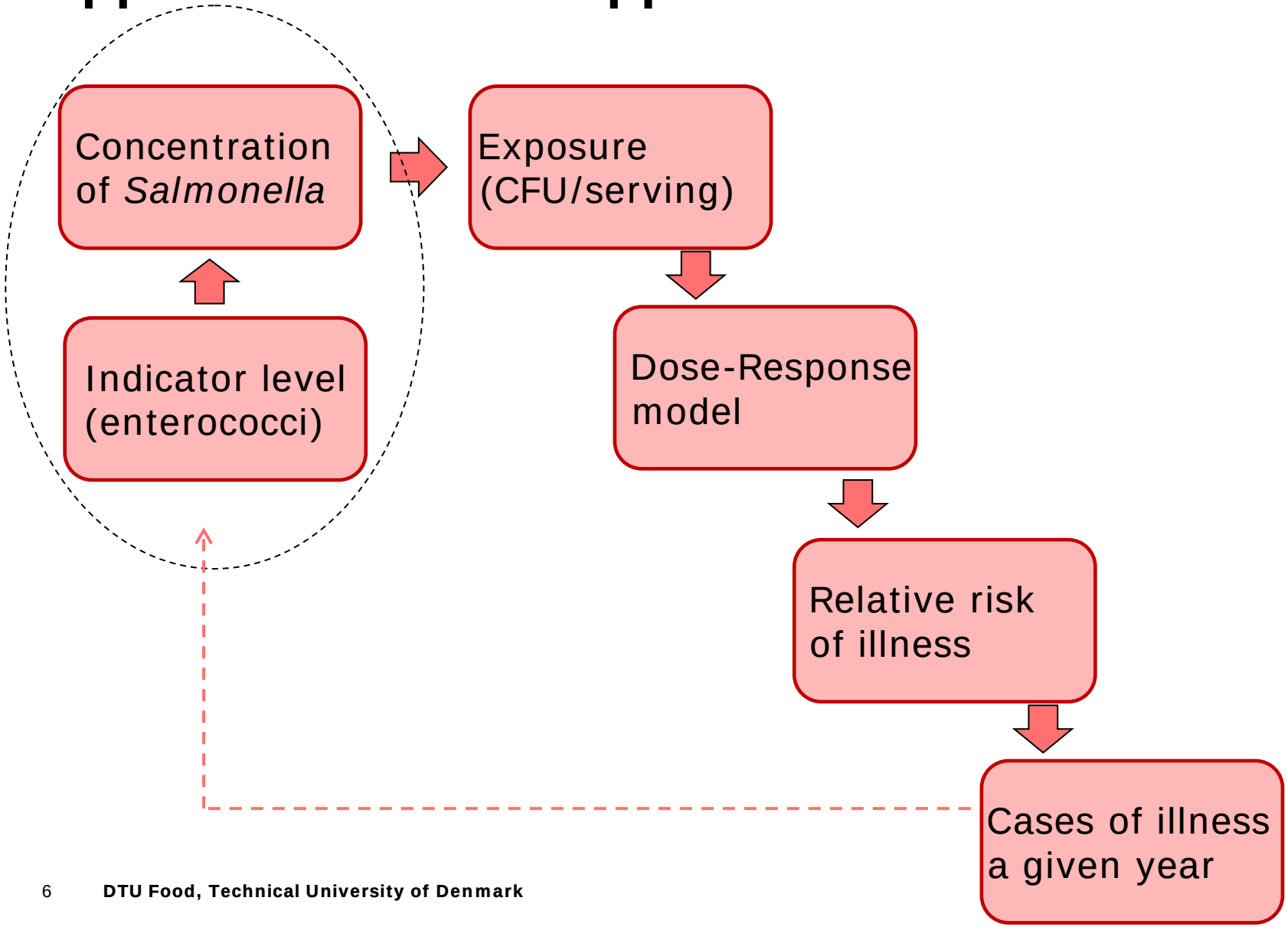
Objective

- To develop an approach which can be used to define risk-based microbiological criteria for enterococci, to control *Salmonella* in pork cutting plants and retail butchers

- How?
  - By combining the observed positive correlation between *Salmonella* and enterococci with consumer risk modelling*
  - By associating a consumer risk to a certain level of enterococci

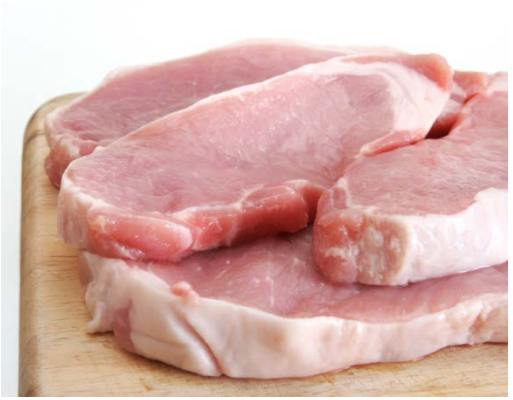
*Duarte ASR, Nauta MJ, Aabo S. Variation in the effect of carcass decontamination impacts the risk for consumers. Food Control 2016;59:12-19.

Applied risk-based approach



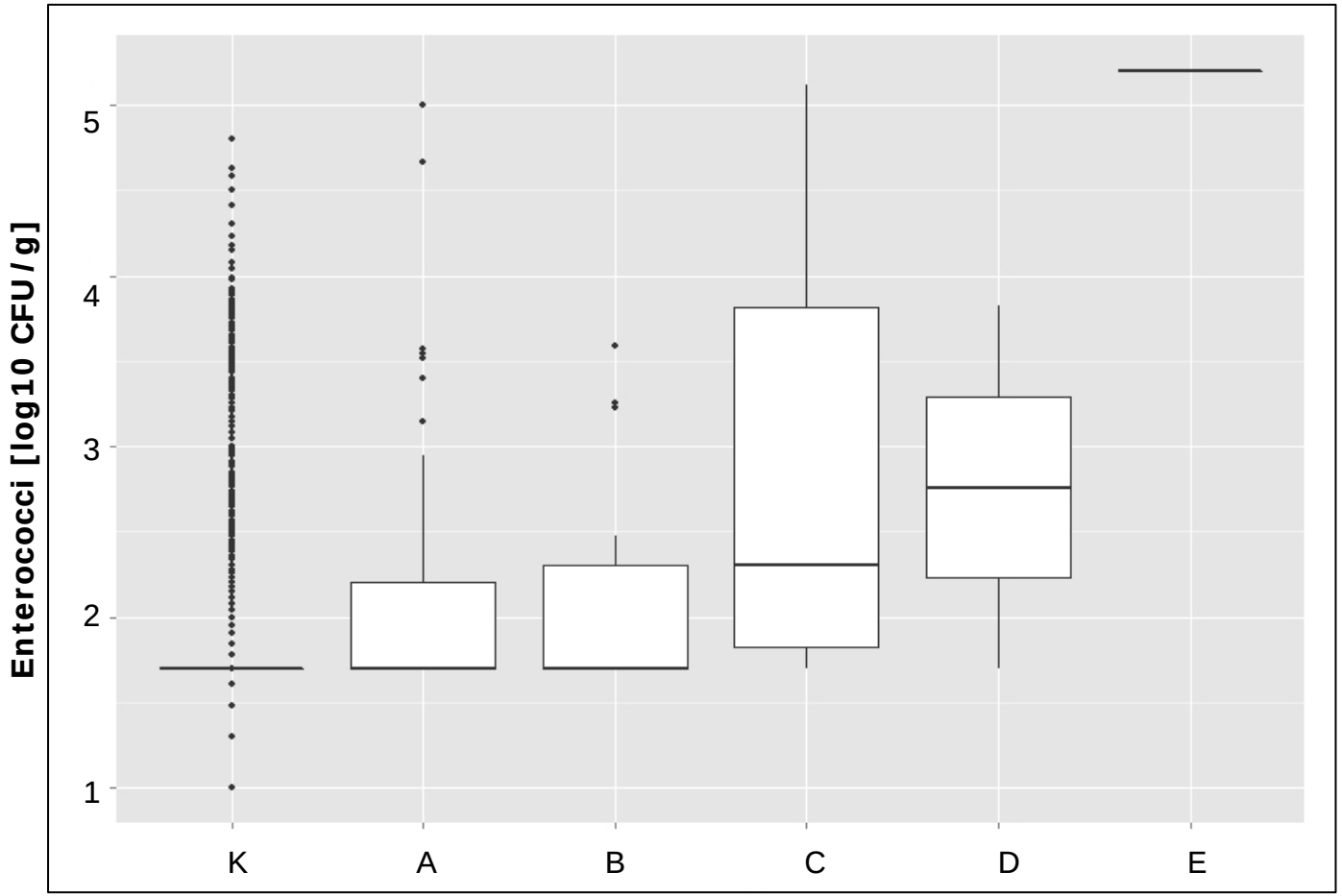
Primary study - method

- 5,310 pork samples
- 18 Cutting plants and 414 retail butchers in DK
- Cuttings and minced meat
- Analyses:
  - *Salmonella* (qualitatively, semi-quantitatively)
  - enterococci (quantitatively)



Results from primary sampling – correlation between *Salmonella* and enterococci

	Conc. [CFU / g]
K	< 0.04
A	0.04 – 0.4
B	0.4 – 4
C	4 – 40
D	40 – 400
E	> 400



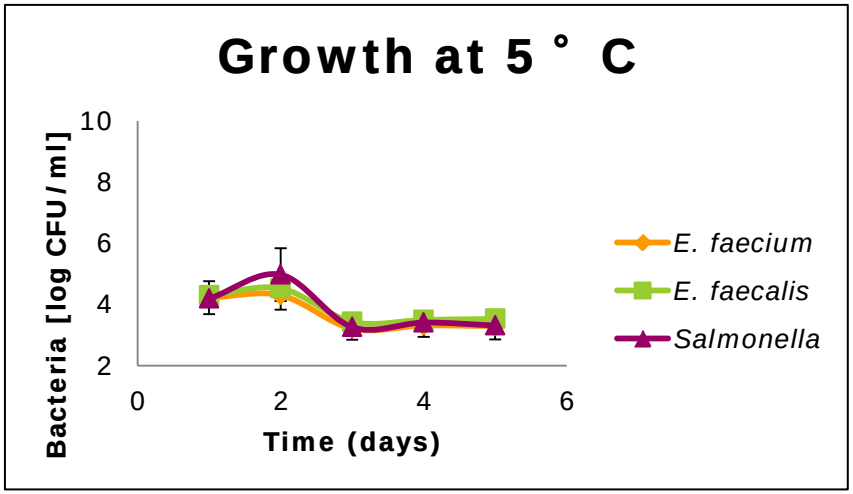
N_{total} = 5,310

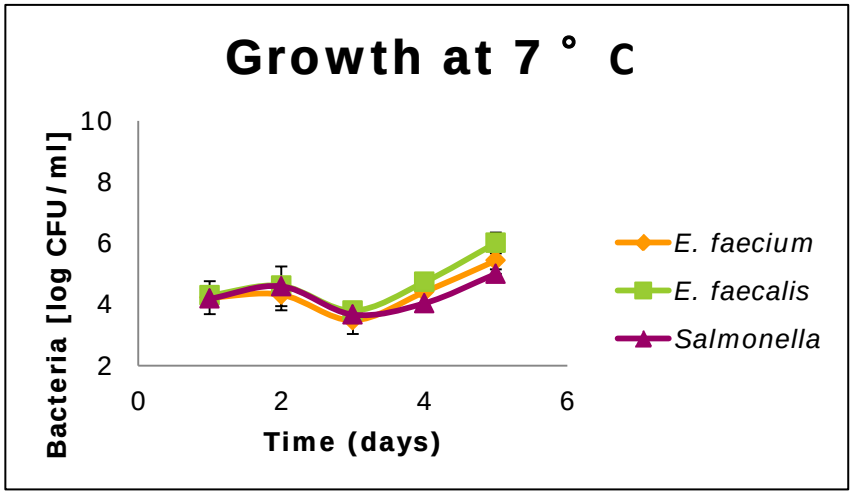
Growth experiment - method

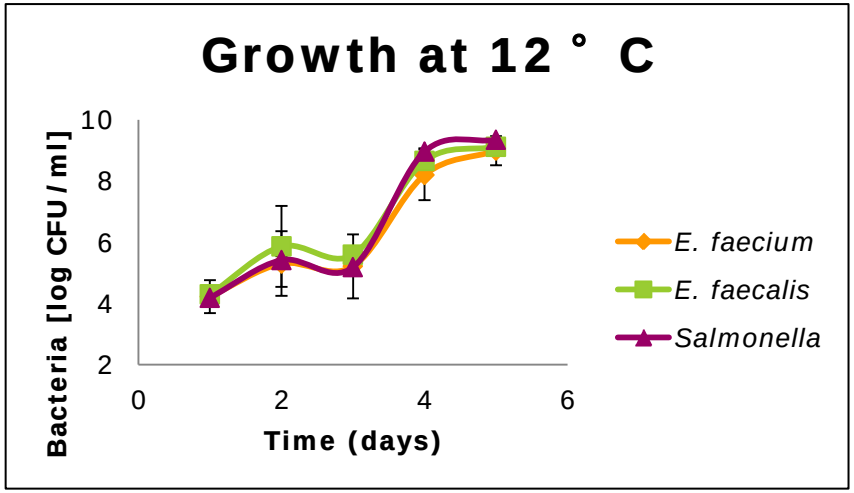
- Media: BHI broth
- Bacteria:
  - 3 *E. faecium*
  - 3 *E. faecalis*
  - 3 *S. enterica* subsp. *enterica*

  Serovars: Typhimurium, Infantis and Derby
- Temperatures: 5, 7 and 12° C
- Duration: 5 days

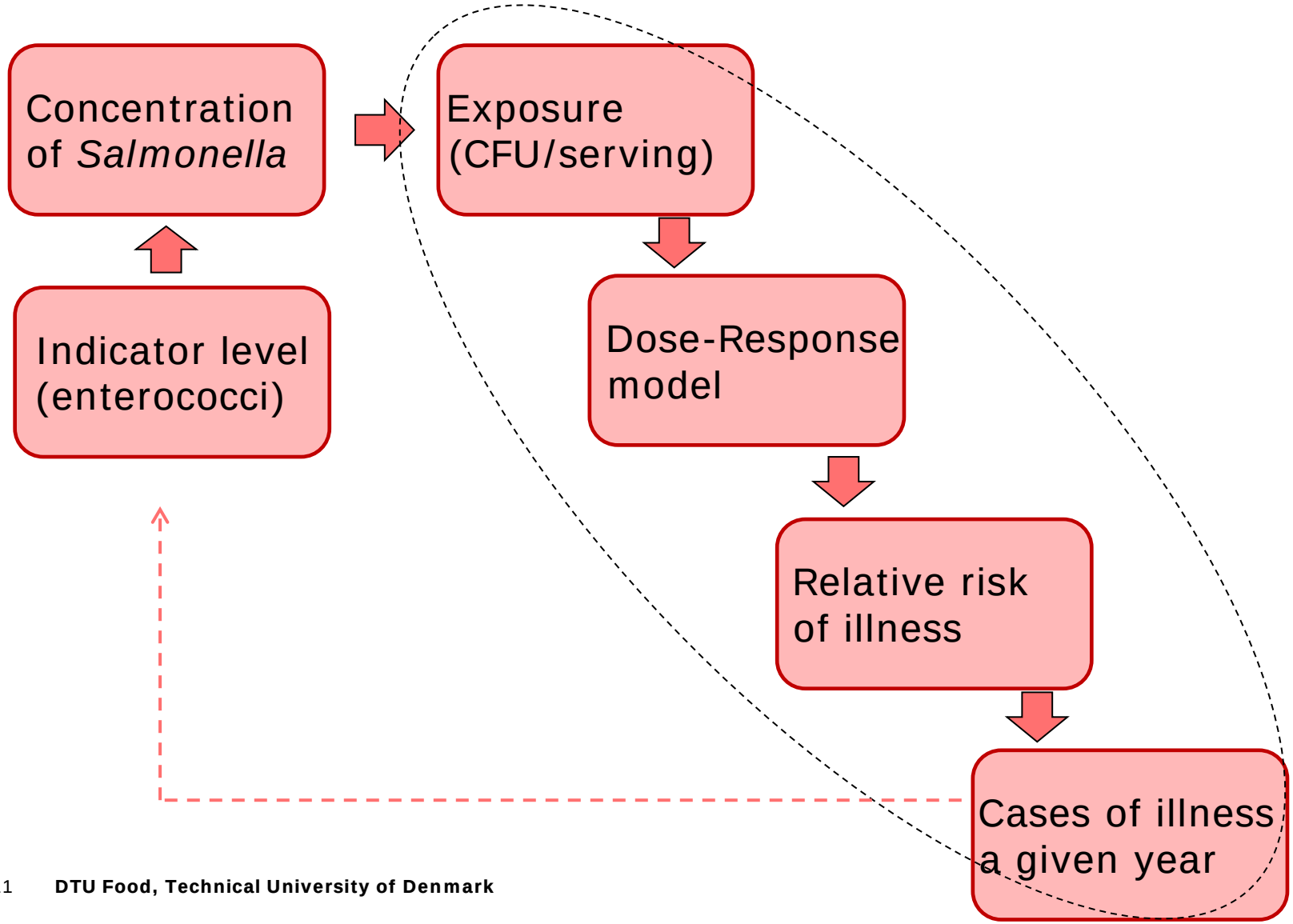
Results from growth experiment







Applied risk-based approach



The risk model - method

- Based on the quantitative model developed by Duarte et al. (2016)*
- Input:
  - The level of enterococci
  - The corresponding level of *Salmonella* is assumed to be the mean of the semi-quantitative interval
- Output:
  - Relative mean population risk of salmonellosis
  - Number of salmonellosis cases associated to each enterococci level
- Assumptions:
  - Enterococci and *Salmonella* have common growth characteristics
  - The reduction factor *a*, is based on 507,222,432 servings of 100 g pork yearly in DK

*Duarte ASR, Nauta MJ, Aabo S. Variation in the effect of carcass decontamination impacts the risk for consumers

Scenarios tested in the risk model

	Unit	Sc. 1	Sc. 2	Sc. 3
Limit for enterococci	Log CFU/g	4.0	3.0	2.0

Results from the risk model

	Unit	Sc. 1	Sc. 2	Sc. 3
Limit for enterococci	Log CFU/g	4.0	3.0	2.0
Relative risk reduction	%	75.7	86.6	88.2
Samples with a level of enterococci > the limit value	%	0.36	3.99	15.8

Perspectives

- To use this risk-based approach for defining microbiological limits for a hygiene indicator

- To develop risk-based process hygiene criteria in pork cutting plants and retail butchers

Sum up

- Positive correlation between the quantitative level of enterococci and *Salmonella* in pork
- By use of risk modelling the level of enterococci was associated to a relative consumer risk of salmonellosis
- The approach can be used to define microbiological limits in a risk-based manner

Thank you for your attention!